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REPORT

ON THE

POINT ACCNI COAL PROPERTY,

SYDNEY COAL FIELD,

CAPE BRETON.

BY

HENRY YOULE HIND, M. A.

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HALIFAX, N. S.

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POINT ACONI COAL MINES,

Near Sydney, Cape Breton.

1.—THE SYDNEY COAL.

The Sydney Coal field of Cape Breton, has been practically known since 1827.

In that year the General Mining Association commenced shipping coal, and their exports alone up to the present time considerably exceed one million tons.

The coal of the Sydney Mines has been almost exclusively taken from one seam, called the Main Coal seam. It is highly esteemed as a domestic coal and for the production of Steam. American, French and British Naval Officers have officially reported on this Coal and have uniformly awarded to it high commendation. "Its steam power is little inferior to that of Cardiff coal, and equals that of Newcastle." (Report of the Director of Naval construction at Brest.)

The Point Aconi property derives its chief importance from its being wholly underlaid by this important coal to the extent of 21,600,000 tons.

2.—SITUATION OF THE PROPERTY.

Point Aconi lies nearly due north from the entrance to Sydney Harbour. It is the most northern extremity of Boulardarie Island, which is separated from the main land of Cape Breton by the Little and Great Bras d'Or Straits.

The property under consideration, three and a half square miles, is wholly submarine as regards the ownership of the coal, but according to the present mining laws of Nova Scotia, the coal can be won by shafts sunk at any point on the land which appears most desirable, and does not interfere with existing colliery works. The present proprietors likewise own twenty acres of land near the peninsula of Point Aconi, conveniently situated, with the right to purchase more if desirable.

The position and boundaries of the property are shown on the accompanying plans, as well as its relations to the great colliery of

the General Mining Association, which is now in part submarine, as at Lloyd's Cove, and to another important colliery at Low Point (the Victoria), which is wholly submarine, and at the present time in successful operation. It may also be stated that the Government Inspector of Mines mentions in his report for 1867, that the General Mining Association have pushed their workings of the Main Seam under the sea at Lloyd's Cove, "and this district of the mine has been regularly worked since, in the same manner as hitherto practised, with the exception of an enlargement in the size of the pillars. No increase of water has been met with, nor is there any change of importance."

In 1868 the Inspector further reports, that the operations "in the Lloyd's Cove District, under the sea, are being regularly carried on, and present no change in any respect."

3.—GENERAL DESCRIPTION OF THE ROCKS.

A section of the Coal measures is exposed on Boulardarie Island, between Point Aconi, and the out-crop of the Millstone Grit.

The general dip is north easterly at an angle of 6 degrees on Boulardarie Island; at Alder and Mope Points, the dip inclines more to the east, but about the same angle.

At Sydney Harbour where a very favourable opportunity exists for studying the rocks, the following details of the section are well exposed between the Millstone Grit and the Cranberry Head seam. (See Plans.)

Vertical thickness of Section of the Coal Measures.		1800 Feet.
General Dip 7° N. 60° E.		
Number of coal seams.	- - - - -	31
Thickness of coal seams, varying from $\frac{1}{2}$ inch to six ft.		
Aggregate thickness of coal.	- - - - -	37 Feet.
Aggregate thickness of Bituminous Shales, some of which approach Cannel coal.		
	- - - - -	26.5 do.
Thickness of Sandstones, many of the beds massive.		562 do.
Thickness of Arenaceous and Argillaceous Shales.		1127 do.
Thickness of Underlays.	- - - - -	99 do.
Limestone*.	- - - - -	3.11 do.
Total horizontal length of this Section.	- - - - -	5000 Yards.

There is no material difference between the mineral composition and physical structure of the strata on Boulardarie Island (coal measures), and the continuation of the same beds at Sydney Harbour. The coal seams show slight variations which will be

*Vide Section in detail by R. Brown, Esq., Journal of the Geological Society of London, 1849

noticed under the description of the seams, but the general characteristics are the same. There is a probable fault running up the Little Bras d'Or strait, whose influence on the working of the property will be discussed in subsequent pages.

4.—THE MAIN COAL SEAM.

Assuming that the Main Coal Seam is the lowest which would be worked on the Aconi property for many years to come, it is necessary only to enumerate those which lie above it, and which would be passed through in sinking a shaft to win the Main coal on Point Aconi Peninsula as indicated on the plan.

Depth of Shaft at Point indicated on the plan to strike	
the main Coal. - - - - -	690 Feet.
Passing through Seam of thickness unknown at a depth of	527 do.
Passing through Seam of thickness unknown at a depth of	354 do.
Passing through Lyle Seam at depth - - -	330 do.
Passing through Crandal Seam at depth - - -	224 do.

The Paint and Carr seams are not intersected by this shaft, both of them lying north from the shaft on the Aconi peninsula, but the Paint seam is pierced by the shaft at Alder Point, as described further on.

The main Coal Seam, as already stated, is the chief source of supply to the General Mining Association at their Sydney Colliery. Its thickness is slightly variable.

At the Low Point Colliery it is 6 feet three inches of excellent coal, with four inches at the roof of inferior quality, making a total thickness of - -	6 ft. 7 in.
At the coast exposure on the west side of Sydney Harbour it is - - - - -	6 ft. 0 in.
At the workings in the Queen's Pit in 1863 (G. M. A.) it was - - - - -	5 ft. 6 in.
In 1866 it was reported by the Inspector to average	6 ft. 0 in.
At Point Aconi its total thickness exceeds, - - -	8 ft. 0 in.
but some inches of the roof are of inferior quality, hence in the estimate of the available quantity of coal from the seam on the Aconi property it is taken as - - - - -	6 ft. 0 in.

The coal from this seam has been examined by numerous and competent experts, and tested on a large scale.—(1)

(1.) In 1860 the Inspector of Mines reported that a cargo of 450 tons of the Coal was shipped by order of the French Government to Brest. The director of naval construction reported on it as stated in a preceding paragraph.

MR. JOHNSON for the United States Government in 1842 gave the following analysis :—

Moisture.	-	-	-	-	-	3.125
Volatile combustible matter.	-	-	-	-	-	23.819
Fixed Carbon.	-	-	-	-	-	67.570
Ash.	-	-	-	-	-	5.495
						100.000

HOW, IN 1861.

FROM SYDNEY MINES.

Moisture and Volatile Combs. matter.	-	-	-	-	31.87
Fixed Carbon.	-	-	-	-	64.59
Ash.	-	-	-	-	3.54
					100.00

Specific gravity.	-	-	-	-	1.340
Evaporative power.	-	-	-	-	8.87

DAWSON, IN 1867.

FROM VICTORIA MINES.

	Top Bench.	Bottom Bench.
Volatile matter.	39.6	37.8
Fixed Carbon.	57.2	59.6
Ash.	3.2	2.6
100.00		100.00

This coal sells at \$1.00 per ton more than any other coal from Cape Breton for domestic purposes. It is largely used by French, English and American Men of war. In 1860, no less than 66 of these vessels called at Sydney for supplies of this coal.

5.—METHOD OF MINING AT POINT ACONI.

A main shaft provided with suitable partitions, as indicated on the plan, would be about 460 feet from either coast of the Point. It might be placed so as to be within 200 feet from either coast, but it is desirable to leave ample room for necessary buildings, yards &c., and future extension of the works.

The coal will be reached at a depth of 690 feet, say in round numbers 120 fathoms.

The distance to drive a double drift each way before the Submarine coal could be won on either side, would be 460 feet. The cost of driving on the coal is 40 cents a cubic yard.

The drifts, two on each side should be the full height of the seam, about nine feet, so as to allow not only a good roof, but an upper air passage of three feet in the working drift, to be maintained for

ventilation, separated by a floor, in addition to the other means of ventilation hereafter mentioned.

At Alder Point there is a Drift on the Paint Seam which already exposes three hundred feet of the Seam. This work has been done chiefly with a view to carry away the surface water, and prepare the ground for putting down the main shaft.

6.—AMOUNT OF COAL ACCESSIBLE.

For present purposes it is sufficient to consider the construction of works adequate to control the coal situated within a radius of 1000 yards from the main shaft on either side, as shown by a dotted line on the plan.

This area will command about 4,280,000 tons from the shaft at Point Aconi, and 2,000,000 tons from a similar shaft on Alder or Mope Points as at M on the plan.

Allowing one third for pillars and waste, the yield would amount to 100,000 tons for 41 years.

Thus:—Available coal from Main Seam at Point Aconi, within a radius of 1000 yards from shaft - 4,280,000
Deduct one third for pillars and loss, and there remains - 2,850,000
or 100,000 tons for 28 years.

At Alder or Mope Point:—

Available coal from main Shaft within a radius of
1000 yards - - - - - 2,000,000
Deduct $\frac{1}{3}$ for pillars and waste, and there remains - 1,330,000
or 100,000 tons for 13 years.

The mean gives 100,000 tons for 41 years.

A radius of one mile from the shaft at Point Aconi would command 13,000,000 tons from the MAIN COAL SEAM. The extreme depth below the surface at that distance would be about 1200 feet, or 200 fathoms below the sea level.

The practical question of moment is one almost exclusively touching on ventilation. The roof is firm, and the absence of local disturbance in the strata precludes the probability that drainage water will be troublesome.

At Low Point Colliery, a three inch pipe drains the mine 400 feet deep and beneath the sea. This can not be said of any inland mine in Nova Scotia, and not of many elsewhere. It is well known that decomposing atmospheric influences extend from 60 to 90 feet in rocks not covered with water. It appears very probable that no decomposing influence extends beyond a few feet in rocks permanently covered with sea water, and it is also probable that works under the

sea fifty fathoms deep, will be drier than those on land, in consequence of the roof being less decomposed by atmospheric agencies, and the rocks generally less permeable near the surface and consequently at considerable depths below it,

7.—MODE OF VENTILATION.

In the Great Tunnel at Mount Cenis, already, up to February 1869, excavated $3\frac{6}{10}$ miles or 6300 yards on one side, and where they are unable to get air *down* by means of shafts, they carry an archway below the level and force the air through it.

At Seigelsberg mines in Hungary an adit level $1\frac{1}{4}$ mile long, without a shaft was constructed by running two shafts down, as is done in English coal mines, with drifts parallel to one another, one as the main drift, the other for forced air, which passed through, (on its backward or return course,) the main drift.

Sir W. B. Armstrong in his address before the Institution of Mining Engineers, 3rd August, 1869, states. "As regards ventilation, the Fan machines of the several constructions tried, have already exhibited great superiority over the old method of ventilating by an up-cast Furnace Shaft; and although the efficiency of the furnace system of ventilation is increased by depth, there is reason to believe that the fan will maintain its superiority to greater depths than are likely to be reached in mining."

With regard to Fan ventilation Mr. W. Cochrane stated in a paper read before the Institute of Mechanical Engineers at the Annual Congress, that "there could be no question that any practical requirement in the ventilation of mines could be satisfied by the Fan System, (Guibal's Ventilator) and it could not be surpassed in simplicity of construction, small liability to accident, and the little wear and tear to which its working parts were subjected."

At Newcastle dip workings have already been executed for considerably more than a mile to the dip of the Engine Pit bottom.

At Ashton-under-Lyne, the Astley Shaft is 2100 feet deep; from the bottom of this shaft, the engine plane to the dip is more than a mile in length. The deep workings are 1500 feet deeper than the bottom of the shaft and 3600 feet below the surface.

It need scarcely be stated that the object in placing the shaft on the neck of the peninsula at Point Aconi is to enable drifts to be carried both to the north east, and south west from the same shaft. It would very materially diminish the first expenses, if a shaft were placed at the point (P) on the plan. But in view of ex-

tensive operations and looking to the future, this position would not be advisable.

A shaft, say at (P), one thousand yards from the Crop, would only require to be 320 feet deep to reach the coal, but the workings would not only be limited on the rise by the boundaries of the property ; but the distance from the loading grounds would be considerably increased.

8.—THE LOADING GROUND.

The loading ground is deep, capacious and well sheltered. There are three modes of access to it, one by the Little Bras d'Or Straits, one by the Great Bras d'Or Straits, and one by St. Peter's Canal at the South Western extremity of Cape Breton Island.

The Little Bras d'Or at present will only admit vessels drawing 11 feet water at high tide, but a competent engineer has estimated the expense of blasting the flat sandstone rock at the entrance to the strait at \$4000. The Great Bras d'Or Strait admits vessels of any size, and there is deep water throughout both Straits to the loading ground with the exception named.

The St. Peter's Canal admits vessels drawing 14 feet water, and not exceeding 26 feet beam.

The admiralty Chart shows the depth of water between all the points named in fathoms. A tug would be a necessary adjunct to the works.

Communication with the loading ground will be by tramway or a light $2\frac{1}{2}$ feet Railway with stationary engines, from the main shafts to the loading ground.

Distance from Point Aconi Shaft, to loading ground one mile and three quarters.

Distance from Alder Point Shaft one quarter of a mile, assuming the shaft to be located at Point M on the Maps hereafter described. Grade, in part level, in part a gentle slope from the shafts to the loading ground at a mean elevation of from 20 to 26 feet above tide.

9.—PROBABLE FAULT.

The foregoing pages have been written upon the assumption that the attitude of the rocks underlying the whole of the property was undisturbed, with the exception of the gentle dip to North-east and East.

There is, however, considerable probability that the property is physically divided into two distinct portions by a Fault or Break,

which is represented by a red line on the plans. This supposed Fault passes up the Little Bras d'Or Strait and has resulted from an uplift to the extent of about four hundred feet of a considerable tract of country to the North-west of the fault, which extends to an unknown distance to the North-east and South west, far beyond the limits of the property on either course.

The effect which this great break will have upon the working of the property influences only the area South of it, or that portion which would be commanded by the Alder Point Shaft.

In view of the great probability of the existence of this break, it would be advisable to place the Alder Point Shaft at, or near M as shown on the large plan.

The following would then be the depths at which the different seams of coal would be reached.

Depth of Main Coal at Point M	-	-	-	720 Ft.
" " Lyle Seam	-	-	-	340.
" " Crandall	-	-	-	234.
" " Paint Seam	-	-	-	55.

An inspection of the Plans will show the effect of this Break. The seams which were originally continuous are now in consequence of the uplift, heaved apart as represented by.

$$\begin{array}{ccccccc}
 a & - & - & - & a \\
 b & - & - & - & b \\
 c & - & - & - & c \\
 d & - & - & - & d
 \end{array}$$

Dislocation produced by Faults are extremely numerous in the British coal fields, and some of them have treble the vertical displacement which occurs in the Sydney coal field.

The Shaft at Point M takes in the Paint Seam, whose outcrop lies to the North East of the Point Aconi Shaft.

As the existence of the Break does not appear to be known, and is not represented on Professor Leslie's Maps of the Sydney Coal field, I shall give my reasons at length for supposing it to exist.

The outline sketch plan of a part of the Sydney Coal field shows the known out-crop in continuous lines of the Sydney Main Coal. On Little Bras D'Or Strait it has not been found between the points *a*—*a*, and is supposed by some to lie in the bed of the Strait. If this were the case, the distance between the out-crops of the Main seam and the Paint seam at the entrance of the little Bras d'Or Strait ought to involve an angle of dip of about 15 degrees, but the angle does not exceed 6 or 7 degrees.

If there were a cross anticlinal or undulation at the entrance to the Straits, the dips of the strata would certainly show it, as the rocks there are well exposed in Mural cliffs.

Upon the assumption that there is a break caused by an uplift to the extent of about 400 feet on the Boulardarie side, the known outcrops of the Main, Lyle, Crandall, and Paint Seams become intelligible and agree on both sides of the break in horizontal distance apart and angle of dip, with the results of calculation, as well as in structural arrangement generally.

Ignoring the existence of a break, the observed outcrops do not appear to be susceptible of intelligible reconciliation with observed facts.

I do not think that the break materially affects the value of the property on the side of deterioration, but it suggests a modification in the mode of working the Alder Point portion of the property, which at the first blush presents itself.

It has this advantage, that the Paint Seam becomes accessible from the same Shaft as would be used to work the Main Seam, and it has this disadvantage that it involves locating the Main Shaft at some distance from the Break (as at M) in order to work on both sides simultaneously, otherwise the operations on the north side would terminate the moment the miners came to the dead wall of the break.

10.—SEAMS OF COAL INDEPENDENTLY OF THE MAIN COAL SEAM.

The subjoined synopsis by Principal Dawson of McGill College, Montreal, gives the thickness and chemical constituents of the principal Coal Seams which in their continuation underlie this property, rejecting those which are under four feet. They are.

1. Duncan McGillvery Seam.
2. Shelly Seam of the Sydney Mines.
3. Willie Fraser Seam.
4. Lyle Seam.
5. No. III Seam.

Some of these are important on the property as they thicken at their North Westerly outcrops.

Thus the No. III Seam is over five feet in thickness, but the coal is, where opened on adjacent properties, too much impregnated with sulphuret of iron to be esteemed as a first Class Coal.

The Willie Fraser Seam is about 5 feet thick.

The Duncan McGillvery has the following thickness.

Coal.	-	-	-	-	-	2 ft. 3 inches.
Clay Parting.	-	-	-	-	-	9 "
Coal.	-	-	-	-	-	6 "
						3 ft. 6 inches

SYNOPSIS OF THE PRINCIPAL COAL SEAMS AT VICTORIA MINES.—(Order descending.)

Name of Bed.	Thickness.	Volatile matter.	Coke.	Fired Carbon.	Ash.	Remarks.
"Carr"	4 ft. 0 in.	39.0	61.0	59.0	2.0	Ash reddish gray. Coke highly vesicular.
"Paint"	8 ft. 0 in.	38.2	61.2	59.4	1.8	Ash red. Coke highly vesicular. Sample from lower beach.
"Crandall"	4 ft. 4 in.	35.4	64.6	63.0	1.6	Ash light reddish. Coke somewhat compact.
"Ross" MAIN COAL.	6 ft. 3 in.	38.7	61.3	58.4	2.9	Ash reddish gray. Coke moderately vesicular.
"Hugh McGillivray" ..	5 ft. 0 in.					Not assayed. Quality reported somewhat inferior to Ross seam.
"Frazer" LINGAN...	6 ft. 0 in.	31.4	68.6	62.4	6.2	Ash dark reddish gray. Coke somewhat compact. This coal has some of the properties of Cannel. It has great heating power, and produces much dense carbonaceous gas, but is inferior in purity to the others.
Total thickness.....	33 ft. 7 in.					

The thickness given are at right angles to the plane of the beds, and include only clean coal independent of partings. Coals under 4 feet thick are excluded as not at present profitable. The gas-producing power of the several coals will be found to be nearly in proportion to their amounts of volatile matter, and their heating power nearly in proportion to their amounts of fixed carbon. The four first coals are eminently valuable in both respects, and also in their small quantity of ashes. The "Crandall" excels in heating power; the "Car" in gas-producing power; the "Paint" and "Ross" are intermediate.

CONCLUSION.

The entire property contains 21,700,000 tons in the Main Coal Seam. Deducting one half for all contingencies, such as pillars, waste, proximity to the Fault (which would very probably only crush the coal on the line of Fracture), and there remains 10,800,000 tons, or sufficient to furnish 100,000 tons per annum, for 108 years from the Main Seam alone, leaving the others in reserve.

It must also be borne in mind that there is no reason why the workings should not extend beyond the present limits seawards of the property if eventually required.

The only question of moment, namely, that relating to the ventilation, has been satisfactorily answered by the opinions of the most eminent Mining Engineers quoted in preceeding paragraphs.

The method of winning the coal is cheap, expeditious and free from many risks and expenses incident to coal mining.

The market is yearly increasing, and the pre-eminence of the coal for steam and domestic purposes has been established for a number of years on a very extended scale.

HENRY Y. HIND, M. A.,
GEOLOGIST.

Windsor, N. S., Dec. 1st., 1869.